

Data Evaluation Record on the Acute Toxicity of Mancozeb to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....}

EPA MRID Number 47486101

Data Requirement: PMRA Data Code: {.....}
 EPA DP Barcode: 360288
 OECD Data Point: {.....}
 EPA Guideline: 850.4150

Test material: Dithane M-45 (AI: Mancozeb)**Purity:** 81.0%

Common name

Chemical name: IUPAC: Manganese ethylenebis(dithiocarbamate) (polymeric) complex with zinc salt
 CAS name: [[2-[(dithiocarboxy)amino]ethyl]carbamdithioato(2-)-κS,κS']manganese mixture with
 [[2-[(dithiocarboxy)amino]ethyl]carbamdithioato(2-)-κS,κS']zinc
 CAS No.: 8018-01-7
 Synonyms

Primary Reviewer: Moncie Wright
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Date: 04/02/09

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Date: 05/04/09

Primary Reviewer: {.....}
{EPA/OECD/PMRA}

Date: {5/24/2010}

Secondary Reviewer(s): {.....}
{EPA/OECD/PMRA}

Date: {.....}

Reference/Submission No.: {.....}

Company Code {.....} [For PMRA]
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Use Site Category: {.....} [For PMRA]
EPA PC Code 014504

Date Evaluation Completed: {dd-mm-yyyy}

CITATION: Lee, B. 2008. Mancozeb: Effects on the Vegetative Vigor of Non-Target Terrestrial Plants (Tier I). Unpublished study performed by ABC Laboratories, Inc., Columbia, Missouri. Laboratory Study Number: 63399. Study sponsored by Mancozeb Task Force c/o McDermott, Will and Emery, Washington, D.C. Mancozeb Task Force Study No. 2007-01. Study completed July 17, 2008.

DISCLAIMER: This document provides guidance for EPA and PMRA reviewers on how to complete a data evaluation record after reviewing a scientific study concerning the acute toxicity of a pesticide to terrestrial vascular plants. It is not intended to prescribe conditions to any external party for conducting this study nor to establish absolute criteria regarding the assessment of whether the study is scientifically sound and whether the study satisfies any applicable data requirements. Reviewers are expected to review and to determine for each study, on a case-by-case basis, whether it is scientifically sound and provides sufficient information to satisfy applicable data requirements. Studies that fail to meet any of the conditions may be accepted, if appropriate; similarly, studies that meet all of the conditions may be rejected, if appropriate. In sum, the reviewer is to take into account the totality of

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factors related to the test methodology and results in determining the acceptability of the study.

EXECUTIVE SUMMARY:

The effect of Mancozeb on the vegetative vigor of monocot (corn, *Zea mays*; oat, *Avena sativa*; onion, *Allium cepa*; and ryegrass, *Lolium perenne*) and dicot (cucumber, *Cucumis sativa*; lettuce, *Lactuca sativa*; oilseed rape, *Brassica napus*; soybean, *Glycine max*; radish, *Raphanus sativus*; and tomato, *Lycopersicon esculentum*) crops was studied at nominal concentrations of 0 (negative and solvent controls), and 0.017 lbs ai/A. Measured concentrations were <0.00001 (<MQL, negative control), and 0.02 lbs ai/A.

The growth medium used in the seedling emergence test was a mixture of collected silt and sand soils that were classified as a sandy loam soil (pH 7.8, % organic matter 0.6%). The surviving plants per pot were recorded and taken for measuring dry weight and height.

Survival was 100% in the negative and solvent controls, and the single treatment group across all species tested. There was no inhibition in plant height across all species. The level of inhibition in dry weight across all treatments was extremely mild to nonexistent, with the highest inhibition exhibited by ryegrass at 5.1%.

The study authors' results indicate that based on all endpoints, the application rate is the NOAEC for all species tested, and the EC₂₅ values lie above the application rate (reported nominally to be 0.017 lbs ai/A).

The study author did not fully describe the phytotoxicity rating system. Only cucumber experienced injury of note, with a rating of 10 (slight injury).

All species were unaffected by the two treatments. The most sensitive monocot and dicot species could not be determined. The NOAEC for all species was the mean-measured application rate, 0.02 lbs ai/A.

Maximum Labeled Rate: Not reported

Results Synopsis

Monocot

EC ₅₀ /IC ₅₀ :	>0.02 lb ai/A	95% C.I.: N/A
EC ₂₅ /IC ₂₅ :	>0.02 lb ai/A	95% C.I.: N/A
EC ₀₅ /IC ₀₅ :	>0.02 lb ai/A	95% C.I.: N/A
NOEC:	0.02 lb ai/A	
Slope:	N/A	Std err: N/A
Most sensitive monocot:	Could not be determined.	
Most sensitive parameter:	Could not be determined.	

Dicot

EC ₅₀ /IC ₅₀ :	>0.02 lb ai/A	95% C.I.: N/A
EC ₂₅ /IC ₂₅ :	>0.02 lb ai/A	95% C.I.: N/A
EC ₀₅ /IC ₀₅ :	>0.02 lb ai/A	95% C.I.: N/A
NOEC:	0.02 lb ai/A	
Slope:	N/A	Std err: N/A
Most sensitive dicot:	Could not be determined.	
Most sensitive parameter:	Could not be determined.	

This toxicity study is classified as ACCEPTABLE and satisfies the guideline requirement for a Tier I Terrestrial Plant Vegetative Vigor toxicity study.

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Table 1 (Tier I studies). Summary of most sensitive parameters by species at the 0.02 lbs ai/A treatment level.

Species	Plant height (mm)			Dry weight (g)		
	Control	Treatment	%difference	Control	Treatment	%difference
Corn	917	928	-1	2.708	2.703	0
Oat	622	619	0	0.689	0.666	3
Onion	369	371	-1	0.243	0.238	2
Ryegrass	259	267	-3	0.101	0.096	5
Cucumber	346	392	-13	2.727	2.831	-4
Lettuce	209	220	-5	1.058	1.058	0
Oilseed rape	258	263	-2	3.245	3.193	2
Radish	160	170	-6	0.686	0.689	0
Soybean	649	658	-1	3.508	3.419	3
Tomato	240	246	-3	2.264	2.259	0

Table 1a (Tier I studies). Summary of most sensitive parameters by species at the 0.02 lbs ai/A treatment level.

Species	Survival (%)		
	Control	Treatment	%difference
Corn	100	100	0
Oat	100	100	0
Onion	100	100	0
Ryegrass	100	100	0
Cucumber	100	100	0
Lettuce	100	100	0
Oilseed rape	100	100	0
Radish	100	100	0
Soybean	100	100	0
Tomato	100	100	0

I. MATERIALS AND METHODS

GUIDELINE FOLLOWED:

This study was conducted according to U.S. EPA Pesticide Assessment Guidelines, Subdivision J, Series 123-1, OPPTS 850.4150 Vegetative Vigor (Tier I) and the U.S. EPA Standard Evaluation Procedure, "Non-Target Plants: Seed Germination/Seedling Emergence and Vegetative Vigor Tiers 1 and 2", and the ABC protocol. The following deviations from OPPTS 850.4150 were noted:

1. All species were tested under identical environmental conditions rather than separating the warm-loving species from the cold-loving species.
2. The physico-chemical properties of the test material were not reported.

These deviations do not impact the acceptability of the study.

COMPLIANCE:

Signed and dated No Data Confidentiality, GLP and Quality Assurance statements were provided. This study was conducted in compliance with the requirements of US EPA FIFRA GLP (40 CFR Part 160), with the following exception:

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Latest water characterizations performed in February 2008.

A. MATERIALS:

1. Test Material Dithane M-45 (AI: Mancozeb)

Description: Solid

Lot No./Batch No. : VC0588R223 (Lot No.)

Purity: 81.0%

Stability of compound under test conditions: Recovery of mancozeb was 125% of the nominal test concentrations at study initiation.
(OECD recommends chemical stability in water and light)

Storage conditions of test chemicals: Stored under ambient conditions.

Table 2. Physical/chemical properties of Dithane M-45 (AI: Mancozeb).

Parameter	Values	Comments
Water solubility at 20EC	Not reported.	
Vapor pressure	Not reported.	
UV absorption	Not reported.	
pKa	Not reported.	
Kow	Not reported.	

2. Test organism:

Monocotyledonous species: Corn (*Zea mays*; Family Gramineae; X68585), Oat (*Avena sativa*; Family Gramineae; Ogle), Onion (*Allium cepa*; Family Amaryllidaceae; Yellow Granex Hybrid) and Ryegrass (*Lolium perenne*; Family Gramineae; Linn); *EPA recommends four monocots in two families, including corn.*

Dicotyledonous species: Cucumber (*Cucumis sativus*; Family Cucurbitaceae; Straight Eight), Lettuce (*Lactuca sativa*; Family Compositae; Grand Rapids), Oilseed Rape (*Brassica napus*; Family Cruciferae; Wichita), Soybean (*Glycine max*; Family Leguminosae; Williams 82), Radish, (*Raphanus sativus*; Family Cruciferae; Crimson Giant), and Tomato (*Lycopersicon esculentum*; Family Solanaceae; Beefsteak); *EPA recommends six dicots in four families, including soybean and a root crop.*

OECD recommends a minimum of three species selected for testing, at least one from each of the following categories: Category 1: ryegrass, rice, oat, wheat, and sorghum; Category 2: mustard, rape, radish, turnip, and Chinese cabbage; Category 3: vetch, mung bean, red clover, fenugreek, lettuce, and cress.

Seed source: Cucumber, lettuce, radish, and tomato obtained from Meyer Seed Company; oilseed rape obtained from Kansas State University; soybean obtained from Missouri Foundation Seeds; corn obtained

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from Syngenta Seeds; oat obtained from Ohio Foundation Seed; onion obtained from Henry Field Seed Co.; and ryegrass obtained from Hummert International.

Prior seed treatment/sterilization: Not reported.

Historical % germination of seed: Radish, 85%; corn, 88%; cucumber, 80%; oat, 99.5%; oilseed rape, 95%; onion, 95%; soybean, 85%; tomato, 90; lettuce, 85%; and ryegrass, 90%

Seed storage, if any: Seeds were stored refrigerated until test initiation.

B. STUDY DESIGN:

1. Experimental Conditions

- a. Limit test: A limit test was not described.
- b. Range-finding study: A range-finding study was not conducted.
- c. Definitive Study

Table 3: Experimental Parameters - Vegetative Vigor

Parameters	Vegetative Vigor	
	Details	Remarks
		Criteria
Duration of the test	21 days	<i>Recommended test duration is 14-21 days.</i>
Number of seeds/plants replicate	10-12 plants per replicate, divided between 2-10 pots per replicate with 3-10 seeds per pot at planting	<i>Five plants per replicate are recommended.</i>
Number of plants retained after thinning	1-5 plants per pot per 2-10 pots per replicate	
<u>Number of replicates</u>		
Control:	4	<i>Four replicates per dose are recommended</i>
Adjuvant control:	4	
Treated:	4	

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Parameters	Vegetative Vigor	
	Details	Remarks
		Criteria
<u>Test concentrations (lbs ai/A)</u> Nominal: Measured:	0 (negative and solvent controls), and 0.017 lbs ai/A <0.00001 (<MQL, negative control), and 0.02 lbs ai/A	<i>Five test concentrations should be used with a dose range of 2X or 3X progression</i>
<u>Method and interval of analytical verification</u> LOQ: LOD:	Samples were analyzed for mancozeb at test initiation using GC with a flame photometric detector. 0.00001; Reported as the minimum quantifiable unit. Not reported.	
Adjuvant (type, percentage, if used)	Latron B-1956; 0.25% v/v	
<u>Test container (pot)</u> Size/Volume Material: (glass/polystyrene)	<u>Onion, lettuce, ryegrass, radish, and oat:</u> 15 cm (diameter) x 10 cm (deep) <u>Corn, cucumber, oilseed rape, soybean, and tomato:</u> 10 x 10 cm (area) x 12 cm (deep) Plastic	<i>Non-porous containers should be used.</i> <i>OECD recommends that non-porous plastic or glazed pots be used.</i>
Growth facility	Greenhouse.	
Method/depth of seeding	Ryegrass, onion, oilseed rape, radish, lettuce, and tomato planted at 6 mm depth; corn, oat, cucumber and soybean were planted at 20 mm.	
<u>Test material application</u> Application time including the plant growth stage Number of application	Test material was applied on Day 0 to the test pots.	

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Parameters	Vegetative Vigor	
	Details	Remarks
		<i>Criteria</i>
<p>Application interval</p> <p>Method of application</p>	<p>Each species was treated once</p> <p>N/A; single application</p> <p>Test material was sprayed using an overhead track sprayer equipped with a TeeJet nozzle.</p>	
<p><u>Details of soil used</u></p> <p>Geographic location</p> <p>Depth of soil collection</p> <p>Soil texture</p> <p> % sand</p> <p> % silt</p> <p> % clay</p> <p>pH:</p> <p>% organic carbon</p> <p>CEC</p> <p>Moisture at 1/3 atm (%)</p>	<p>Hartsburg, Missouri (Soil Lot Nos. G82107MOSILT and G82107MOSAND)</p> <p>Soil from the two lots was mixed to obtain the test soil</p> <p>6-10 inches</p> <p>Sandy loam</p> <p>66</p> <p>26</p> <p>8</p> <p>7.8</p> <p>0.4</p> <p>10.2</p> <p>10.1</p>	<p>% organic matter: 0.6</p> <p>Bulk density: 1.35 g/cc (disturbed)</p> <p><i>EPA prefers soil mixes containing sandy loam, loam, or clay loam soil with no greater than 2% organic matter. Glass beads, rock wool, and 100% acid washed sand are not preferred.</i></p> <p><i>OECD prefers the soil to be sieved (0.5 cm) to remove coarse fragments. Carbon content should not exceed 1.5% (3% organic matter). Fine particles (under 20um) makeup should be between 10 and 20%. The recommended pH is between 5.0 and 7.5.</i></p>
<p>Details of nutrient medium, if used</p>	N/A	
<p><u>Watering regime and schedules</u></p> <p>Water source/type:</p> <p>Volume applied:</p> <p>Interval of application:</p> <p>Method of application:</p>	<p>Not reported.</p> <p>Not reported.</p> <p>Not reported.</p> <p>Top-watering performed on the day of application, and thereafter sub-irrigation saucers were used.</p>	<p><i>EPA prefers that under foliage watering or bottom watering be utilized for vegetative vigor studies so that the chemical is not washed out of the soil during the test.</i></p>
<p>Any pest control method/fertilization, if used</p>	<p>½ tablespoon Peter's 20-20-20:1 gallon of water twice during the study period.</p>	

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Parameters	Vegetative Vigor	
	Details	Remarks
		Criteria
<u>Test conditions</u> Temperature: Photoperiod: Light intensity and quality: Relative humidity:	20.2-34.9°C 16L:8D 337.9-572.1 $\mu\text{Em}^{-2}\text{s}^{-1}$ Natural sunlight supplemented with high pressure sodium lights 10-56%	 <i>EPA prefers that the cold vs warm loving plants be tested in two separate groups to optimize plant growth.</i> <i>OECD prefers that the temperature, humidity and light conditions be suitable for maintaining normal growth of each species for the test period.</i>
<u>Reference chemical (if used)</u> Name: Concentrations:	N/A	
Other parameters, if any	None	

2. Observations:

Table 4: Observation Parameters - Vegetative Vigor

Parameters	Vegetative Vigor	
	Details	Remarks
Parameters measured (i.e., plant height, dry weight or other endpoints)	Survival, dry weight, shoot length, and phytotoxicity.	
Measurement technique for each parameter	Plant condition and survival were assessed visually. Seedlings were clipped at soil level, and the shoots weighed to the nearest milligram to determine dry weight per plant. For plants with a bulb or leaf rosette, shoot length was measured to the nearest whole centimeter from the base of the stem to the tip of the tallest leaf; for all others,	

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	measurements were made from the base of the stem to the apical bud.	
Observation intervals	Survival and phytotoxicity were assessed weekly. Shoot length and dry weight were evaluated after test termination.	
Other observations, if any	None.	
Were raw data included?	Yes.	
Phytotoxicity rating system, if used	0%- No injury; and 100%- maximum effect (complete mortality)	

II. RESULTS and DISCUSSION:

A. INHIBITORY EFFECTS:

Vegetative Vigor:

Survival was 100% in the negative and solvent controls, and the single treatment group across all species tested.

The study author's results indicated that there was no inhibition in plant height across all species. The level of inhibition in dry weight across all treatments was extremely mild to nonexistent, with the highest inhibition exhibited by ryegrass at 5%.

The study authors' results indicate that based on all endpoints, the application rate is the NOAEC for all species tested, and the EC₂₅ values lie above the application rate (reported as 0.017 lbs ai/A).

The study author did not fully describe the phytotoxicity rating system. Only cucumber experienced injury of note, with a rating of 10 (slight injury).

B. REPORTED STATISTICS:

The study author did not perform statistical analyses due to lack of a perceived effect.

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Table 5: Reported effect of Mancozeb on Vegetative Vigor

Species	Results summary for dry weight (lb ai/A)*									
	Weight (g)	NOEC	EC ₀₅	95%CI	EC ₂₅	95%CI	EC ₅₀	95%CI	slope	std err
Corn	2.668-2.73	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Oat	0.574-0.748	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Onion	0.214-0.256	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Ryegrass	0.069-0.132	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Cucumber	2.494-3.018	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Lettuce	0.88-1.158	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Oilseed rape	2.824-3.554	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Radish	0.661-0.734	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Soybean	3.352-3.497	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Tomato	2.023-2.727	NR	NR	NR	>0.02	NR	NR	NR	NR	NR

NR – not reported

* The study author reported an application rate of 0.017 lbs ai/A; however, the reviewer-calculated rate derived from the measured concentrations of mancozeb in the spray solutions and the spray volume application is 0.02 lbs ai/A.

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Table 5a: Reported effect of Mancozeb on Vegetative Vigor

Species	Results summary for height (lb ai/A)									
	Height (mm)	NOEC	EC ₀₅	95%CI	EC ₂₅	95%CI	EC ₅₀	95%CI	slope	std err
Corn	862-990	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Oat	594-657	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Onion	360-377	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Ryegrass	228-320	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Cucumber	373-423	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Lettuce	189-257	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Oilseed rape	206-276	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Radish	162-175	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Soybean	587-714	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Tomato	219-279	NR	NR	NR	>0.02	NR	NR	NR	NR	NR

NR – not reported

* The study author reported an application rate of 0.017 lbs ai/A; however, the reviewer-calculated rate derived from the measured concentrations of mancozeb in the spray solutions and the spray volume application is 0.02 lbs ai/A.

Table 5b: Reported effect of Mancozeb on Vegetative Vigor

Species	Results summary for survival (lb ai/A)*									
	%	NOEC	EC ₀₅	95%CI	EC ₂₅	95%CI	EC ₅₀	95%CI	slope	std err
Corn	100	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Oat	100	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Onion	100	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Ryegrass	100	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Cucumber	100	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Lettuce	100	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Oilseed rape	100	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Radish	100	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Soybean	100	NR	NR	NR	>0.02	NR	NR	NR	NR	NR
Tomato	100	NR	NR	NR	>0.02	NR	NR	NR	NR	NR

NR – not reported

* The study author reported an application rate of 0.017 lbs ai/A; however, the reviewer-calculated rate derived from the measured concentrations of mancozeb in the spray solutions and the spray volume application is 0.02 lbs ai/A.

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Plant Injury Index										
Control	Corn	Oat	Onion	Ryegrass	Cucumber	Lettuce	Oilseed rape	Radish	Soybean	Tomato
0-10 (1.3)	3	0	0	0	10	3	3	0	0	0

0%- No injury, 1-10 – slight injury, and 100%- maximum effect (death of plant)

C. VERIFICATION OF STATISTICAL RESULTS BY THE REVIEWER:

Any species exhibiting an inhibition of 5% in survival, height or dry weight relative to the negative control was statistically analyzed; toxicity values for all other species and endpoints were determined visually. All analyses were conducted using the negative control. The 0.02 lbs ai/A treatment group was compared to the negative control using a two-tailed t-test in Excel 2003. Before analysis, the reviewer compared the negative and solvent controls if the solvent control had inhibitions or promotions of growth of 5% or greater. All analyses were conducted using the measured application rate in terms of lbs ai/A.

Table 6: Effect of Mancozeb on Vegetative Vigor

Species	Results summary for dry weight (lb ai/A)									
	Weight (g)	NOEC	EC ₀₅	95%CI	EC ₂₅	95%CI	EC ₅₀	95%CI	slope	std err
Corn	2.668-2.73	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Oat	0.574-0.748	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Onion	0.214-0.256	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Ryegrass	0.069-0.132	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Cucumber	2.494-3.018	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Lettuce	0.88-1.158	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Oilseed rape	2.824-3.554	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Radish	0.661-0.734	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Soybean	3.352-3.497	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Tomato	2.023-2.727	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A

Table 6a: Effect of Mancozeb on Vegetative Vigor

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Species	Results summary for height (lb ai/A)									
	Height (mm)	NOEC	EC ₀₅	95%CI	EC ₂₅	95%CI	EC ₅₀	95%CI	slope	std err
Corn	862-990	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Oat	594-657	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Onion	360-377	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Ryegrass	228-320	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Cucumber	373-423	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Lettuce	189-257	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Oilseed rape	206-276	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Radish	162-175	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Soybean	587-714	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Tomato	219-279	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A

NR – not reported

Table 6b: Effect of Mancozeb on Vegetative Vigor

Species	Results summary for survival (lb ai/A)									
	%	NOEC	EC ₀₅	95%CI	EC ₂₅	95%CI	EC ₅₀	95%CI	slope	std err
Corn	100	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Oat	100	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Onion	100	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Ryegrass	100	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Cucumber	100	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Lettuce	100	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Oilseed rape	100	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Radish	100	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Soybean	100	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A
Tomato	100	0.02	>0.02	N/A	>0.02	N/A	>0.02	N/A	N/A	N/A

NR – not reported

Plant Injury Index										
Control	Corn	Oat	Onion	Ryegrass	Cucumber	Lettuce	Oilseed rape	Radish	Soybean	Tomato
0-10 (1.3)	3	0	0	0	10	3	3	0	0	0

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0%- No injury, 1-10 – slight injury, and 100%- maximum effect (death of plant)

Monocot

EC₅₀/IC₅₀: >0.02 lb ai/A 95% C.I.: N/A

EC₂₅/IC₂₅: >0.02 lb ai/A 95% C.I.: N/A

EC₀₅/IC₀₅: >0.02 lb ai/A 95% C.I.: N/A

NOAEC: 0.02 lb ai/A

Slope: N/A Std err: N/A

Most sensitive monocot: Could not be determined.

Most sensitive parameter: Could not be determined.

Dicot

EC₅₀/IC₅₀: >0.02 lb ai/A 95% C.I.: N/A

EC₂₅/IC₂₅: >0.02 lb ai/A 95% C.I.: N/A

EC₀₅/IC₀₅: >0.02 lb ai/A 95% C.I.: N/A

NOAEC: 0.02 lb ai/A

Slope: N/A Std err: N/A

Most sensitive dicot: Could not be determined.

Most sensitive parameter: Could not be determined.

D. STUDY DEFICIENCIES:

There were no study deficiencies.

E. REVIEWER'S COMMENTS:

The reviewer visually determined NOAEC and EC₂₅ values when inhibitory effects of <5% were observed. The reviewer's results agreed with the study author's.

The study author measured weight on a per replicate basis. The reviewer converted weight per replicate to weight per plant based on the number of plants and replicates used in the study; there was 100% survival in this study.

The study author divided up the plants for each species into 1-5 plants per pot, with 2-10 pots per replicate.

All species were tested under similar environmental conditions.

F. CONCLUSIONS:

This study is acceptable. The most sensitive monocot and dicot species could not be determined. All species were unaffected by the two treatments.

Most sensitive monocot and EC₂₅: None, >0.02 lbs ai/A.

Most sensitive dicot and EC₂₅: None, >0.02 lbs ai/A.

III. REFERENCES:

- 1 U.S. EPA. 1982. Pesticide Assessment Guidelines, Subdivision J, Hazard Evaluation: Non-target Plants. 1996. OPPTS 850.4100.
- 2 U.S. EPA. 1986. Hazard Evaluation Division. Standard Evaluation Procedure. Non-Target Plants: Seed Germination/Seedling Emergence and Vegetative Vigor – Tiers 1 and 2.

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- 3 U.S. EPA. Pesticide Reregistration Draft Rejection Rate Analysis: Ecological Effects. Special Review and Registration Division and Environmental Fate and Effects Division. February, 1994.

APPENDIX I. OUTPUT OF REVIEWER'S STATISTICAL VERIFICATION:

<i>Cucumber height</i>	<i>Neg ctrl</i>	<i>Solv ctrl</i>
Mean	345.25	367
Variance	1892.917	4214
Observations	4	4
Pooled Variance	3053.458	
Hypothesized Mean Difference	0	
df	6	
t Stat	-0.55664	
P(T<=t) one-tail	0.298952	
t Critical one-tail	1.94318	
P(T<=t) two-tail	0.597903	
t Critical two-tail	2.446912	

<i>Lettuce height</i>	<i>Neg ctrl</i>	<i>Solv ctrl</i>
Mean	208.75	198
Variance	359.5833333	282
Observations	4	4
Pooled Variance	320.7916667	
Hypothesized Mean Difference	0	
df	6	
t Stat	0.848812806	
P(T<=t) one-tail	0.214272485	
t Critical one-tail	1.943180274	
P(T<=t) two-tail	0.42854497	
t Critical two-tail	2.446911846	

<i>Radish height</i>	<i>Neg ctrl</i>	<i>0.02 lbs ai/A</i>
Mean	160	169.5
Variance	118	43
Observations	4	4
Pooled Variance	80.5	
Hypothesized Mean Difference	0	
df	6	
t Stat	-1.49741	
P(T<=t) one-tail	0.092466	
t Critical one-tail	1.94318	
P(T<=t) two-tail	0.184932	

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t Critical two-tail	2.446912
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<i>Ryegrass weight</i>	<i>Neg ctrl</i>	<i>0.02 lbs ai/A</i>
Mean	0.1009	0.095775
Variance	0.000345	0.000719443
Observations	4	4
Pooled Variance	0.000532	
Hypothesized Mean Difference	0	
df	6	
t Stat	0.31415	
P(T<=t) one-tail	0.382022	
t Critical one-tail	1.94318	
P(T<=t) two-tail	0.764043	
t Critical two-tail	2.446912	

<i>Cucumber weight</i>	<i>Neg ctrl</i>	<i>Solv ctrl</i>
Mean	2.72725	2.907925
Variance	0.057524	0.068976
Observations	4	4
Pooled Variance	0.06325	
Hypothesized Mean Difference	0	
df	6	
t Stat	-1.01597	
P(T<=t) one-tail	0.174423	
t Critical one-tail	1.94318	
P(T<=t) two-tail	0.348847	
t Critical two-tail	2.446912	

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<i>Radish weight</i>	<i>Neg ctrl</i>	<i>Solv ctrl</i>
Mean	0.686208	0.718625
Variance	0.003575	0.000621
Observations	4	4
Pooled Variance	0.002098	
Hypothesized Mean Difference	0	
df	6	
t Stat	-1.00091	
P(T<=t) one-tail	0.177755	
t Critical one-tail	1.94318	
P(T<=t) two-tail	0.355511	
t Critical two-tail	2.446912	

